



I-TEAM BRIEF

Virtual Design Construction

Multi-disciplinary performance models for construction design projects

Caltrans is continually looking for ways to deliver construction projects more efficiently. In order to produce high-quality results on an increasing volume of projects, the department will need to implement innovative methods to lower project support costs, accelerate project schedules, have transparency and accountability, improve existing processes and procedure, and encourage the responsible use of resources. **The Caltrans I-Team is exploring the implementation of Virtual Design and Construction (VDC). VDC is a cutting-edge system of integrated multi-disciplinary performance models of design-construction projects.**

READY TO DEPLOY

VDC creates an integrated framework and set of methods linking design-construction modeling to organizational, scheduling, and finance data. This framework enables projects to find integrated solutions to complex interrelated problems.

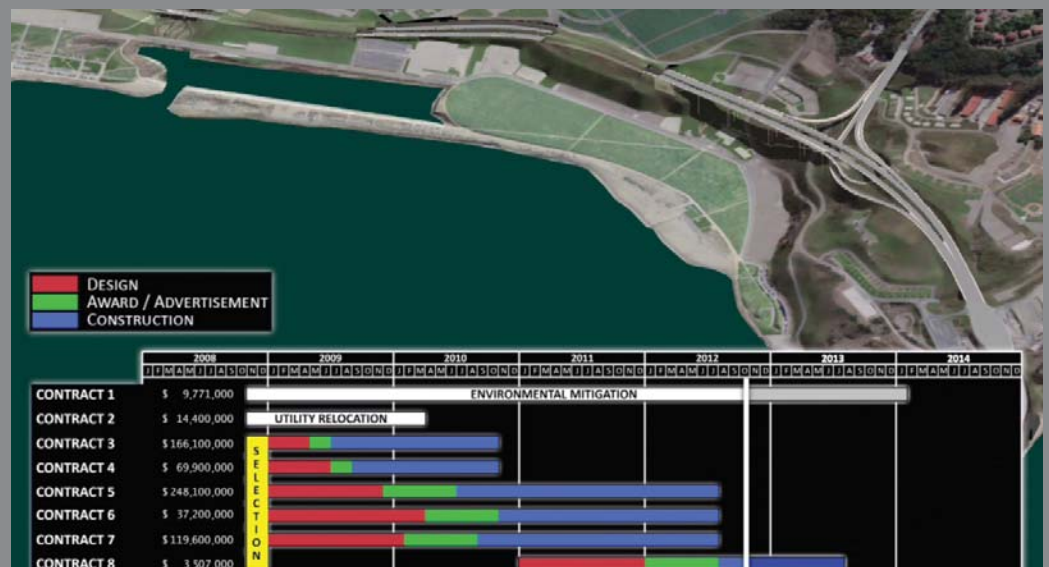
NEW AND IMPROVED

- Visualization of the project for project management and public outreach
- Better communication and planning tools
- More informed decisions on alternatives and construction staging
- Clash detection
- Reduced project costs, reduced waste, decreased project delivery time
- Opportunity to effectively use project special data for owner-operator activities
 - Maintenance and Operation including Asset Management

This video still of Caltrans's Presidio Parkway project in San Francisco is an example of a 5-D model, i.e., spatial x, y, z along with the dimensions of dollars expended over time.

The Innovation Team (I-Team) at the Caltrans Division of Research and Innovation, in cooperation with its partners, develops proven, ready-to-deploy innovations in methods, materials, and technologies that enable Caltrans to provide the most effective management of public services, resources, and infrastructure.

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About Virtual Design Construction

The Center for Integrated Facility Engineering (CIFE) at Stanford University has focused on developing an integrated, model-based approach to address the underlying issues affecting productivity in construction. CIFE Executive director John Kunz and Civil and Environmental Engineering professor Martin Fischer introduced the term Virtual Design and Construction (VDC) in 2001. CIFE is dedicated to leading the teaching, development, and implementation of this design-construction method.

GET STARTED

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Learn More

Center for Integrated Facility Engineering (CIFE) website:

<http://cife.stanford.edu/Mission/index.html>

CIFE VDC Certificate Program

<http://cife.stanford.edu/Courses/Certificate/index.htm>

Virtual Design and Construction: Themes, Case Studies and Implementation Suggestions,

John Kunz and Martin Fischer
http://www.stanford.edu/group/CIFE/online_publications/WP097.pdf

A Guide to Applying the Principles of Virtual Design and Construction (VDC) to the Lean Project Delivery Process, Atul Khanzode, Martin Fischer, Dean Reed, and Glenn Ballard
http://cife.stanford.edu/online_publications/WP093.pdf

Framework and Case Studies: Comparing Implementations and Impacts of 3D/4D Modeling Across Projects,

Ju Gao and Martin Fischer
http://cife.stanford.edu/online_publications/TR172.pdf



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SUCCESSES

- Planning for construction staging on the Alameda – 92/880 interchange.
- Visualization applications on the SF-Oakland Bay Bridge west approach retrofit project.
- Visualization and constructability review in the Presidio Parkway project, resulting in a total cost savings of 30%.

METRICS

VDC's business functions and features have been evaluated by other implementing organizations using the following metrics:

- Schedule compliance
- Number of change orders
- Number of Requests for Information (RFIs)
- Amount of rework during construction
- Amount of prefabrication
- Hours spent by superintendents resolving conflicts
- Project cost savings

Potential metrics for Caltrans:

- Ratio of support to capital costs for capital projects
- Number of change orders
- Utility problems/conflicts
- Reduction of claims
- Amount of data available for asset management

GET READY

The VDC toolkit includes:

- **Product visualization tools** (AutoCAD ADT, Revit) are used to create a common understanding among project participants on how the project will look when it is completed. It can also be used to coordinate the work of various disciplines like mechanical, electrical and plumbing.
- **Product and process modeling and visualization tools** (CommonPoint Project 4D, NavisWorks Timeliner) allow project teams to understand how the building will be constructed over time.
- **Organizational and process modeling tools** (VDT, SimVision) allow project teams to simulate the organizational effort needed to complete the project and to identify potential risks in project organization that might lead to delays.
- **Online collaboration tools** (iRoom, Project Based Learning Lab) allow geographically distributed team members to collaborate using a shared model of product, organization, and process.

This schematic, developed at the Advanced Highway Maintenance and Construction Technology (AHMCT) Research Center at UC Davis, illustrates the VDC environment adjusted for Caltrans use.

Digital Model-Based Planning & Automation

